DOCUMENT RESUME

ED 458 557 CS 014 527

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TITLE The Brain and Reading. Topics in Early Reading Coherence.
INSTITUTION Southwest Educational Development Lab., Austin, TX.
PUB DATE 2001-00-00
NOTE 4p.; HTML version entitled, "Understanding the Brain and Reading."
AVAILABLE FROM Southwest Educational Development Laboratory, 211 E. 7th St., Austin, TX 78701-3281. Tel: 800-476-6861 (Toll Free); Web site: http://www.sedl.org. For full text: http://www.sedl.org/reading/topics/brainreading.html.
PUB TYPE Opinion Papers (120)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Brain; *Brain Hemisphere Functions; Primary Education; *Reading Comprehension; *Reading Instruction; Reading Programs
IDENTIFIERS Neurosciences; Southwest Educational Development Laboratory; *Text Processing (Reading)

ABSTRACT

When a person reads a text to himself or herself, certain parts of the brain are working to try to make sense of different aspects of the information contained in the text. This paper describes what types of activities take place in the human brain when a person is reading. Evidence suggests that to be able to read, children must be able to decode text, translating it into a speech form, and children must also be able to understand spoken language. The paper includes a model of a PET scan and a note on the number of reading programs that claim to be "brain based." (NKA)

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The Brain and Reading

By Sebastian Wren

Topics in Early Reading Coherence

Southwest Educational Development Laboratory

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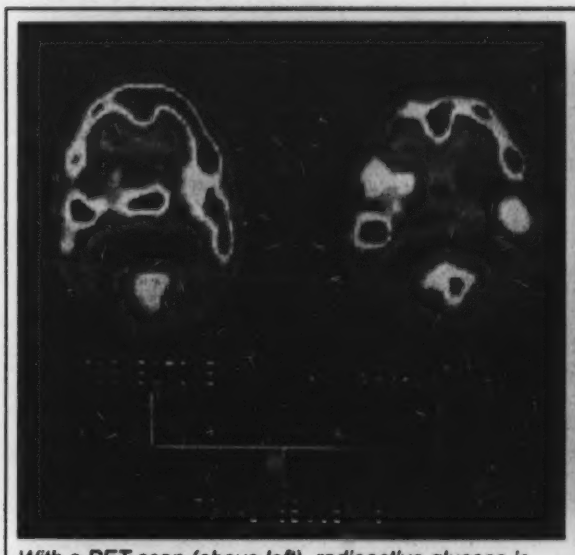
The Brain and Reading

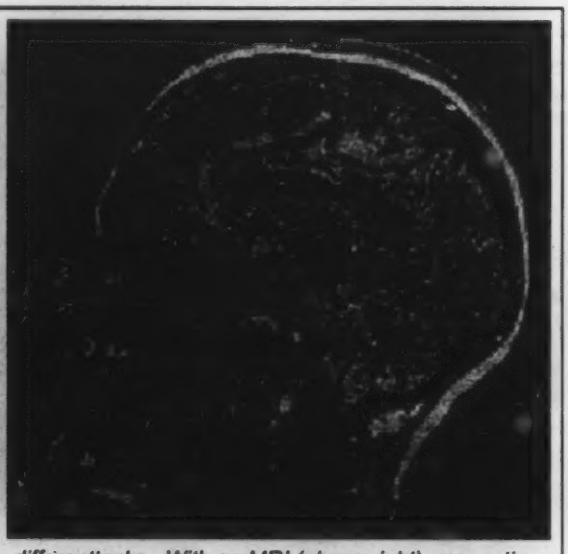
Sebastian Wren, Ph.D.

As you read this passage quietly to yourself, certain parts of your brain are working to try to make sense of different aspects of the information contained in this text. We can actually take a picture of the activity in the brain as its owner engages in certain behaviors (using either a PET scan or an MRI), and the picture tells us what parts of the brain are most active during that behavior. The outer surface of the brain (called the Neocortex) is functionally divided into four lobes – the frontal lobe at the front of the head, the occipital lobe at the back of the head, the temporal lobe on the side, and the parietal lobe on the top.

Right now, as you read this passage of text, your occipital cortex is very active, processing all of the visual information you are encountering – the words, the letters, and the features of the letters. The frontal lobe of your neocortex is engaged in processing the meaning of the text you're reading – the meanings of the words, the sentences, and the big picture, and it is working to relate what you are reading with what you already know. Surprisingly, your temporal lobe (particularly on the left side of your brain if you're right handed) is also active right now, processing all of the "sounds" associated with reading – even though you're reading silently to yourself, the areas of the brain that process speech sounds are active just like they would be if you were listening to somebody speak. Your brain is very structured in the way it processes information. Complex tasks such as reading a passage of text are broken down into easier tasks, and the easier tasks are distributed to the areas of the brain that specialize in those tasks.

While it is impossible at this point to describe what is happening at the cellular level in the brain, at the gross level, what seems to be happening is that the brain is analyzing text at three major levels – the visual features of the words and letters, the phonological representation of those words, and the meanings of the words and sentences. There are other parts of your





With a PET scan (above left), radioactive glucose is injected into the blood stream. The most active neurons absorb more of the radioactive glucose, so it is easy to take a picture of the brain's activity during differenttasks. With an MRI (above right), magnetic fields are generated that cause the nuclei of the neurons to line up, making it possible to take a different kind of picture of the brain's activity.

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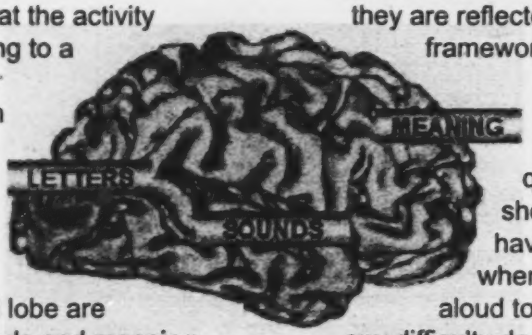
brain that are also quite active when you are reading (e.g. parts of the cerebellum controlling automatic eye movements, parts of the reticular formation responsible for attention, etc.), but the most significant activity is that associated with these three areas of processing.

It is worth noting that the activity associated with listening to a person speak and the activity associated with reading is very similar – in both cases, the temporal lobe (especially on the left side in right-handed people) and the frontal lobe are active processing sounds and meaning, respectively. It is only the addition of the activity in the occipital lobe that separates reading text from listening to speech, and this is consistent with research on the cognitive processes involved in reading. Evidence suggests that, in order to be able to read, children must be able to decode text, translating it into a speech form, and children must also be able to understand spoken language. These two skills are the foundations for reading comprehension, and they are reflected in the structure of the framework that is being described here. When examining a young, struggling reader diagnostically, the first two questions that a teacher should ask are, "Does she have trouble understanding me when I'm talking to her or reading aloud to her?" and "Does she have any difficulty decoding text – especially unfamiliar text?" If a child is having difficulty reading, the answer to one or both of these questions is sure to be, "yes."



Note from the author: There are a troubling number of reading programs out there that claim to be "brain based." These programs allege that they were created based on the most current "brain research" available. Ironically, the citations often given as research support for these "brain-based reading programs" include early 20th century Russian philosopher / researchers Alexandr Luria and Lev Vygotsky, as well as Roger Sperry (who worked with split-brain patients in the 1960s). The claims made by these reading programs are troubling for three reasons. First, the research that is often cited is far from current, and much of what is put forth as current research evidence is, in fact, more philosophy than current, rigorous science. Second, to the extent that good, reputable research is cited, the connections between those research findings and the reading program are unclear. Third, and most troubling, very often what is known about the brain and neuroscience is horribly misrepresented by proponents of these reading programs. Case in point – a description of the research base for one popular "brain-based" reading program suggested (among other things) that as children learn new information, their neurons myelinate, and it was alleged that this reading program was designed to enhance the myelination of children's neurons. Neither of these claims is true – myelination has nothing to do with learning new information, and further, there was no way they could legitimately make the claim that their reading program enhances the myelination of neurons.

Neuroscience is a relatively new field, and the best researchers in the field do not know much more about the operations of the brain during reading than what has been described in this short article. It has been said that we know considerably less about the workings of the human brain than we know about distant stars and galaxies in our universe. We are learning a great deal, but there is a great deal more to be learned. For now, it is most prudent to adopt a healthy skepticism about claims made about "brain-based" reading programs.

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